

REMARKS/ARGUMENTS

Favorable reconsideration of this application is respectfully requested.

Claims 1, 2, 4-8 and 10-26 are pending in this application. Claims 6-8, 10-15 and 19-26 are withdrawn from consideration. Claims 1 and 16 are amended by way of the present amendment. Claims 1-2, 4-5 and 16-18 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. 5,808,345 (Kinzer).

The present invention is directed to an electrode contact section incorporated in a semiconductor device having a semiconductor substrate. The section includes an impurity layer and a contact layer formed in the impurity layer. The impurity layer has a thickness of not more than $1.0\text{ }\mu\text{m}$ from a surface of a semiconductor substrate, and the contact layer has a thickness not more than $0.2\text{ }\mu\text{m}$ from the surface of the semiconductor substrate. Such a structure can reduce contact resistance as well as provide good turn-off speed in the device as has been explained in the previous responses.

According to the prior art, an impurity concentration of the impurity layer having a depth of about $1\text{ }\mu\text{m}$ is as shown in attached reference drawing A. That is, the peak of the impurity concentration is away from the surface of a substrate, and the impurity concentration value is gradually decreased toward the surface of the substrate. Therefore, the impurity concentration at the substrate surface is lowered such that the contact resistance is increased.

In this example profile, i.e., the peak is at a portion deeper than $0.2\text{ }\mu\text{m}$ from the surface of a substrate and the impurity value is gradually decreased at shallower portions, is the same even if the peak of the impurity concentration is raised by increasing the ion implantation amount. In this case, shown in attached reference drawing B, the impurity concentration at the substrate surface is increased, while the turn-off speed is increased because of the increased ion dosage.

In contrast, according to the invention of claims 1 and 16, a contact layer having a depth of no more than $0.2\text{ }\mu\text{m}$ is formed in an impurity layer having a depth of no more than $1\text{ }\mu\text{m}$. With such a structure, the peak of the impurity concentration of the contact layer is higher than that of the impurity layer, as shown in attached reference drawing C. Moreover, the impurity concentration at the surface of the substrate is sufficiently high due to the contact layer.

Thus, the invention of claims 1 and 16 provides a device with an impurity layer, a contact layer, and the claimed impurity profile, different from the prior art. Consequently, the invention of claims 1 and 16 can produce a remarkable advantage of simultaneously realizing both increase in the turn-off speed (i.e., reduction in the carrier injection coefficient) and decrease in the contact resistance.

The Office Action finds Kinzer to teach a semiconductor device having a region 62 formed in the substrate 63 and a body 61 formed in the impurity layer 62, referring to Fig. 4. The Office Action goes on to state, on page 2, that Kinzer is silent with respect to the thickness of the region 62 and body 61. However, referring to column 3, lines 51-54, the thickness of region 62 is about $40\text{ }\mu\text{m}$ for a 600V device. Thus, Kinzer is not silent with respect to the thickness of the region 62. The Office Action then goes on to state that it would have been obvious to form the region 62 to a thickness of $1\text{ }\mu\text{m}$ or less.

Kinzer clearly teaches that the thickness of region 62 for a 600V device is about $40\text{ }\mu\text{m}$. The rejection is entirely based upon the premise that, since there is no teaching regarding the thickness of region 62, it can be concluded that it would be obvious to one skilled in the art to form region 62 to a thickness not more than $1.0\text{ }\mu\text{m}$. This premise is incorrect and thus the conclusion is without support and also incorrect. The rejection must be withdrawn on this basis alone.

It is also clear that there is no suggestion to form region 62 to a thickness of not more than 1 μm . A 40 μm thick region in no way suggests a layer no more than 1 μm in thickness. In fact, such disclosure would teach one skilled in the art not to form region 62 to a thickness of no more than 1 μm . Moreover, the Office Action has not pointed to anything in Kinzer suggesting that region 62 should be formed thinner.

The Office Action also asserts that it would have been obvious to form body 61 to a thickness of not more than 0.2 μm . However, there is absolutely no disclosure or suggestion in Kinzer that body 61 would be of such a thickness. Based upon the drawings, body 61 appears to be in the order of tens of μm thick, which would again clearly suggest to one skilled in the art not to form the layer to a thickness not more than 0.2 μm .

Lastly, the Office Action states that where the general conditions of a claim are disclosed, discovering optimal working ranges involves only routine skill in the art. The Office Action has not provided any basis how one of routine skill, equipped with the disclosure to make region 42 about 40 μm thick, would discover, through routine measures, to make region 62 no more than 1 μm thick. Only an unsupported conclusion is offered. Again, such a conclusion is based upon the erroneous premise that no thickness for region 62 is disclosed in Kinzer. Clearly the Office Action has found some device bearing a vague resemblance to the claimed device, has ignored the expressed teachings of thicknesses in the device, and then cites inapplicable case law to reach an untenable conclusion.

The rejection of claims 1 and 16 must be withdrawn for the several reasons discussed above. There is clearly no support noted in the Office Action for maintaining a rejection of claims 1 and 16 based upon the disclosure of Kinzer. Withdrawal of the rejection of claims 1 and 16 is required as the Office Action has not met its burden under the statutes for rejecting these claims.

It is therefore respectfully submitted that the present application is in condition for allowance and a favorable decision to that effect is respectfully requested.

Respectfully submitted,

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